

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

NISHIKAWA et al.

Application No. Unassigned

Art Unit: Unassigned

Filed: November 15, 2001

Examiner: Unassigned

For: PLASMA GENER-
ATING APPARATUS

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE SPECIFICATION

Replace the paragraph beginning at page 1, line 10, with:

A radar system in which a sheet plasma is used as a reflecting mirror for electromagnetic waves is disclosed in United States Patent Nos. 5,182,496 and 5,814,942. These references describe a method and a device for generating a sheet plasma by applying a high voltage between a cathode and an anode.

Replace the paragraph beginning at page 1, line 15, with:

One angle control method for the sheet plasma is described in an article from IEEE AES System Magazine (October, 1996, p. 38). This article describes a control method setting the sheet plasma at a desired elevation angle with conventional electromagnetic coils.

Replace the paragraph beginning at page 1, line 19, with:

Moreover, Japanese Patent Laying-Open No. 11-087091 discloses a control method in which a laser beam irradiates a cathode at different angles and in which secondary electrons emitted from the cathode aid the plasma generation as well as set a desired azimuth.

Replace the paragraph beginning at page 1, line 26, with:

Angle control of a sheet plasma by the combination of a plurality of electromagnetic coils presents the problem of increased complexity and size of the device. In addition, when providing a large number of electromagnetic coils in order to improve the angle precision, the effective area of the antenna serving as a plasma mirror is reduced so that the antenna gain is decreased. Further, when a laser is used for angle control of the sheet plasma, the provision of a plurality of lasers in the periphery of the cathode to improve precision results in an unfavorable increase in the device size.

Replace the paragraph beginning at page 2, line 3, with:

The present invention is made to solve the above problems, and an object of the present invention is to perform angle control of a sheet plasma with a simple configuration.

Replace the paragraph beginning at page 7, line 2, with:

Fig. 3 is a diagram related to the description of an angle control method of the plasma generating apparatus shown in Fig. 1.

Replace the paragraph beginning at page 7, line 5, with:

Fig. 4 is a diagram related to the description of an angle control method of the plasma generating apparatus shown in Fig. 1.

Replace the paragraph beginning at page 9, line 14, with:

In the plasma generating apparatus thus formed, a rare gas, such as an argon gas, or air is introduced into vacuum container 1, and a high voltage is applied between cathode 2 and anode 3 by high-voltage power supply 4 to form a sheet plasma 6. The electron density and thickness required of the sheet plasma to serve as a plasma mirror relative to directional electromagnetic waves 8 at 10 GHz, for instance, are $1.24 \times 10^{11} \text{ cm}^{-3}$ and above and 4.8 mm or greater, respectively.

IN THE CLAIMS

Cancel claims 1-10 and substitute the following claims therefor:

11. (New) A plasma generating apparatus comprising:
a chamber;
a dielectric within said chamber;
a high-frequency power supply for applying high frequency energy to said dielectric to form a sheet plasma that reflects directional electromagnetic waves from a surface of said dielectric; and
dielectric driving means for driving said dielectric to change an angle of the sheet plasma relative to said chamber.

12. (New) The plasma generating apparatus according to claim 11, including a member of a high-frequency non-transmitting material attached to one surface of said dielectric.

13. (New) The plasma generating apparatus according to claim 11, including a member of a high-frequency absorbing material attached to one surface of said dielectric.

14. (New) The plasma generating apparatus according to claim 11, wherein a surface of said dielectric on a side where the sheet plasma is located is a curved surface.

15. (New) A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode;
high-frequency supply means for supplying a high frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves; and
a moving mechanism for moving said high-frequency supply means to change position of the sheet plasma.

16. (New) The plasma generating apparatus according to claim 15, wherein said high-frequency supply means includes a high-frequency power supply and a high-frequency radiation antenna, and said moving mechanism moves said high-frequency radiation antenna.

17. (New) A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode; and

a plurality of high-frequency supply means for supplying high-frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves.

18. (New) A plasma generating apparatus comprising:
a chamber;
an electron beam source for supplying an electron beam to said chamber;
a metal plate within said chamber;
a nozzle for jetting the electron beam toward said metal plate to form a sheet plasma that reflects directional electromagnetic waves; and
nozzle driving means for driving said nozzle to change an angle of the sheet plasma relative to said chamber.

19. (New) A plasma generating apparatus comprising:
a chamber;
plasma source for supplying a plasma into said chamber;
metal plate within said chamber;
a nozzle for jetting the plasma toward said metal plate to form a sheet plasma that reflects directional electromagnetic waves; and
nozzle driving means for driving said nozzle to change an angle of the sheet plasma relative to said chamber.

IN THE ABSTRACT

Replace the abstract with:

ABSTRACT OF THE DISCLOSURE

A plasma generating apparatus includes a vacuum container, an anode, and a cathode including multiple electrodes, a power supply for applying a high voltage to the anode and the cathode, and switching elements for switching the electrodes in the anode and the cathode to which the high voltage is applied. The combinations of the electrodes

In re Application of Nishikawa et al.
Application No. Unassigned

are switched by switching elements to form a sheet plasma at any desired angle relative to directional electromagnetic waves.


0907588-14501

REMARKS

The foregoing amendments are made to correct minor translational errors and to meet United States requirements as to form. No new matter is added.

Respectfully submitted,

LEYDIG, VOIT & MAYER, LTD.



Jeffrey A. Wyand,
Registration No. 29,458

Suite 300
700 Thirteenth Street, N. W.
Washington, D. C. 20005
Telephone: (202) 737-6770
Facsimiles: (202) 737-6776
Date: November 15, 2001
JAW:cmcg

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

NISHIKAWA et al.

Application No. Unassigned

Art Unit: Unassigned

Filed: November 15, 2001

Examiner: Unassigned

For: PLASMA GENER-
ATING APPARATUS

**AMENDMENTS TO SPECIFICATION, CLAIMS, AND
ABSTRACT MADE VIA PRELIMINARY AMENDMENT**

Amendments to the paragraph beginning at page 1, line 10:

~~Conventionally, a~~ A radar system in which a sheet plasma is used as a reflecting mirror for electromagnetic waves is disclosed, ~~for instance,~~ in United States Patent Nos. 5,182,496 and 5,814,942. These references describe a method and a device for generating a sheet plasma by applying a high voltage between a cathode and an anode.

Amendments to the paragraph beginning at page 1, line 15:

One angle control method for the sheet plasma is described in an article from IEEE AES System Magazine (October, 1996, p. 38). This article describes a control method of setting the sheet plasma at a desired elevation angle with ~~the convention of~~ conventional electromagnetic coils.

0907588 11501

Amendments to the paragraph beginning at page 1, line 19:

Moreover, Japanese Patent Laying-Open No. 11-087091 discloses a control method in which a laser beam ~~is irradiated on~~ irradiates a cathode at different angles and in which secondary electrons emitted from the cathode ~~are used to~~ aid the plasma generation as well as ~~to~~ set a desired azimuth.

Amendments to the paragraph beginning at page 1, line 26:

~~The angle~~ Angle control of a sheet plasma by the combination of a plurality of electromagnetic coils presents the problem of increased complexity and size of the device. In addition, when providing a large number of electromagnetic coils in order to improve the angle precision, the effective area of the antenna serving as a plasma mirror is reduced so that the antenna gain is decreased. Further, when a laser is used ~~to perform~~ ~~the for~~ angle control of the sheet plasma, the provision of a plurality of lasers in the periphery of the cathode to improve ~~the~~ precision results in an unfavorable increase in the device size.

Amendments to the paragraph beginning at page 2, line 3:

The present invention is made to solve the above problems, and an object of the present invention is to perform ~~the~~ angle control of a sheet plasma with a simple configuration.

Amendments to the paragraph beginning at page 7, line 2:

Fig. 3 is a diagram related to the description of an angle control method of ~~a sheet plasma by~~ the plasma generating apparatus shown in Fig. 1.

Amendments to the paragraph beginning at page 7, line 5:

Fig. 4 is a diagram related to the description of an angle control method of ~~the sheet plasma by~~ the plasma generating apparatus shown in Fig. 1.

Amendments to the paragraph beginning at page 9, line 14:

In the plasma generating apparatus thus formed, a rare gas₂ such as an argon gas₂ or air is introduced into vacuum container 1, and a high voltage is applied between cathode 2 and anode 3 by high-voltage power supply 4 to form a sheet plasma 6. The electron density and thickness required of the sheet plasma to serve as a plasma mirror relative to directional electromagnetic waves 8 ~~of at~~ 10 GHz, for instance, are $1.24 \times 10^{11} \text{ cm}^{-3}$ and above and 4.8 mm or greater, respectively.

Add the following claims:

11. (New) A plasma generating apparatus comprising:
 - a chamber;
 - a dielectric within said chamber;
 - a high-frequency power supply for applying high frequency energy to said dielectric to form a sheet plasma that reflects directional electromagnetic waves from a surface of said dielectric; and
 - dielectric driving means for driving said dielectric to change an angle of the sheet plasma relative to said chamber.
12. (New) The plasma generating apparatus according to claim 11, including a member of a high-frequency non-transmitting material attached to one surface of said dielectric.
13. (New) The plasma generating apparatus according to claim 11, including a member of a high-frequency absorbing material attached to one surface of said dielectric.

14. (New) The plasma generating apparatus according to claim 11, wherein a surface of said dielectric on a side where the sheet plasma is located is a curved surface.

15. (New) A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode;
high-frequency supply means for supplying a high frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves; and
a moving mechanism for moving said high-frequency supply means to change position of the sheet plasma.

16. (New) The plasma generating apparatus according to claim 15, wherein said high-frequency supply means includes a high-frequency power supply and a high-frequency radiation antenna, and
said moving mechanism moves said high-frequency radiation antenna.

17. (New) A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode; and
a plurality of high-frequency supply means for supplying high-frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves.

18. (New) A plasma generating apparatus comprising:
a chamber;
an electron beam source for supplying an electron beam to said chamber;
a metal plate within said chamber;

a nozzle for jetting the electron beam toward said metal plate to form a sheet plasma that reflects directional electromagnetic waves; and

nozzle driving means for driving said nozzle to change an angle of the sheet plasma relative to said chamber.

19. (New) A plasma generating apparatus comprising:

a chamber;

plasma source for supplying a plasma into said chamber;

metal plate within said chamber;

a nozzle for jetting the plasma toward said metal plate to form a sheet plasma that reflects directional electromagnetic waves; and

nozzle driving means for driving said nozzle to change an angle of the sheet plasma relative to said chamber.

Amendments to the abstract:

ABSTRACT OF THE DISCLOSURE

~~The present~~A plasma generating apparatus includes a vacuum container, an anode, and a cathode ~~formed by a plurality of~~ including multiple electrodes, a power supply for applying a high voltage to the anode and the cathode, and switching elements for switching the electrodes in the anode and the cathode to which the high voltage is applied. The combinations of the electrodes are switched by switching elements ~~so as~~ to form a sheet plasma at any desired angle relative to ~~the~~ directional electromagnetic waves.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

NISHIKAWA et al.

Application No. Unassigned

Art Unit: Unassigned

Filed: November 15, 2001

Examiner: Unassigned

For: PLASMA GENER-
ATING APPARATUS

PENDING CLAIMS AFTER ENTRY OF PRELIMINARY AMENDMENT

11. A plasma generating apparatus comprising:
a chamber;
a dielectric within said chamber;
a high-frequency power supply for applying high frequency energy to said dielectric to form a sheet plasma that reflects directional electromagnetic waves from a surface of said dielectric; and
dielectric driving means for driving said dielectric to change an angle of the sheet plasma relative to said chamber.
12. The plasma generating apparatus according to claim 11, including a member of a high-frequency non-transmitting material attached to one surface of said dielectric.
13. The plasma generating apparatus according to claim 11, including a member of a high-frequency absorbing material attached to one surface of said dielectric.
14. The plasma generating apparatus according to claim 11, wherein a surface of said dielectric on a side where the sheet plasma is located is a curved surface.

0937588 11501

15. A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode;
high-frequency supply means for supplying a high frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves; and
a moving mechanism for moving said high-frequency supply means to change position of the sheet plasma.

16. The plasma generating apparatus according to claim 15, wherein
said high-frequency supply means includes a high-frequency power supply and a high-frequency radiation antenna, and
said moving mechanism moves said high-frequency radiation antenna.

17. A plasma generating apparatus comprising:
a chamber;
an anode and a cathode within said chamber;
a power supply for applying a voltage to said anode and said cathode to form a low-density plasma between said anode and said cathode; and
a plurality of high-frequency supply means for supplying high-frequency energy to the low-density plasma to form a sheet plasma that reflects directional electromagnetic waves.

18. A plasma generating apparatus comprising:
a chamber;
an electron beam source for supplying an electron beam to said chamber;
a metal plate within said chamber;
a nozzle for jetting the electron beam toward said metal plate to form a sheet plasma that reflects directional electromagnetic waves; and
nozzle driving means for driving said nozzle to change an angle of the sheet plasma relative to said chamber.

19. A plasma generating apparatus comprising:
a chamber;
plasma source for supplying a plasma into said chamber;
metal plate within said chamber;
a nozzle for jetting the plasma toward said metal plate to form a sheet plasma that
reflects directional electromagnetic waves; and
nozzle driving means for driving said nozzle to change an angle of the sheet
plasma relative to said chamber.

09067588-111501